

Novel Polymer Microfluidics Technology for In Situ Planetary Exploration, Phase I

Completed Technology Project (2009 - 2009)



Project Introduction

Los Gatos Research proposes to develop a new polymer based microfluidics technology for NASA planetary science applications. In particular, we will design, build and demonstrate a micro-capillary electrochromatography instrument based on a rigid monolithic porous polymer structure as the stationary phase to analyze complex organic molecules on Mars, Titan and elsewhere in the solar system. Such high performance, small mass and volume, and low power consumption microfluidic sample separation devices are amenable for implementation at wafer level such as miniaturized "lab-on-a-chip" devices. For the Phase I effort, we will design, construct, and testing the micro-chips. The Phase I research will address issues related to performance as well as production methods that can be used for the technology, as well as designing and determining the integrated micro-device and the Phase II prototype. In the Phase II effort, we will construct and test the final prototypes capable of separating all relevant organic molecules for in-situ planetary explorations, thus provide new capabilities for NASA sample separation instrumentation development.

Anticipated Benefits

The polymer microfluidics technology described in this proposal possesses significant commercial potential for a wide range of technologies and applications in markets ranging from specialty medical and aerospace industries to consumer electronics. Commercial devices based on such microfluidics technology envisioned include components for DNA, protein and drug separation and analysis, chemical analysis systems, drug delivery systems, and embedded health monitoring systems. Our proprietary technology vastly improves robustness and reliability, thus clearing one of the last hurdles of a wider acceptance of CEC in the biotechnology and pharmaceutical industries. The proposed polymer microfluidics technology can be readily adapted to NASA's miniature "Micro Laboratories" scientific instrumentations for in-situ exploration of bodies in the solar system. In particular, it is directly applicable to analyze organic molecules on Mars surface to find signature of life as well as to analyze Titan surface to study prebiotic chemistry on Titan. The proposed technology has other broad NASA applications including on-chip biosensors, electrochemical sensors, wet-chemistry systems, as well as high pressure micropumps for fluid positioning, mixing, metering, storage, and filtering systems. In addition, our novel technology is naturally suited to such applications as clinical diagnostics, spacecraft and biosphere environmental monitoring, and toxicology studies.



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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory (JPL)	Lead Organization	NASA Center	Pasadena, California
Los Gatos Research	Supporting Organization	Industry	Mountain View, California

Primary U.S. Work Locations

California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Celestino Jun Rosca

Principal Investigator:

Hong Jiao

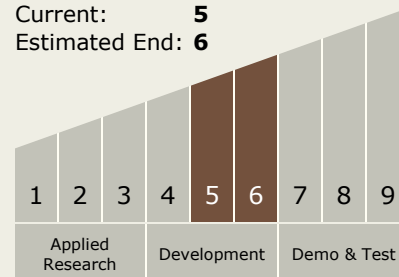
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Technology Maturity (TRL)

Start: **5**
Current: **5**
Estimated End: **6**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - └ TX07.1 In-Situ Resource Utilization
 - └ TX07.1.2 Resource Acquisition, Isolation, and Preparation